

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) An optical control type microwave phase forming device, comprising:

a first optical demultiplexer for branching a light radiated from a first light source into two branch lights;

a second optical demultiplexer for branching a light radiated from a second light source into two branch lights;

a first optical frequency converter for deviating a frequency of one of the branch lights outputted from the first optical demultiplexer by a predetermined frequency based on a first microwave signal to output the resultant light as a first signal light;

a second optical frequency converter for deviating a frequency of one of the branch lights outputted from the second optical demultiplexer by a predetermined frequency based on a second microwave signal to output the resultant light as a second signal light;

a first signal light emitting unit for converting the first signal light into a signal light beam having a predetermined beam width to emit the signal light as a first signal light beam to space;

a second signal light emitting unit for converting the second signal light into a signal light beam having a predetermined beam width to emit the signal light as a second signal light beam to space;

a spatial optical modulator for phase-modulating the first and second signal light beams directly inputted to different areas thereof of the spatial optical modulator to convert the resultant signal light beams into signal light beams having respective desired spatial phase distributions;

an optical multiplexer for converting the first and second signal light beams different in wavelength outputted from the spatial optical modulator into a single multiplex output signal light beam to travel through one and same coaxial optical path;

an optical synthesizer for synthesizing the other branch light outputted from the first optical demultiplexer and the other branch light outputted from the second optical demultiplexer into a local light;

a local light emitting unit for converting the local light into a light beam having a predetermined beam width to emit the light beam as a local light beam to space;

a beam synthesizer for spatially superimposing the first and second light beams outputted from the optical multiplexer, and the local light beam to form a synthetic beam; and

a plurality of optoelectronic converters for spatially sampling the synthetic beam to convert the resultant beam into microwave signals through heterodyne detection to output the microwave signals, respectively.

2. (Currently Amended) An optical control type microwave phase forming device, comprising:

a first optical demultiplexer for branching a light radiated from a first light source into two branch lights;

a second optical demultiplexer for branching a light radiated from a second light source into two branch lights;

a first optical frequency converter for deviating a frequency of one of the branch lights outputted from the first optical demultiplexer by a predetermined frequency based on a first microwave signal to output the resultant light as a first signal light;

a second optical frequency converter for deviating a frequency of one of the branch lights outputted from the second optical demultiplexer by a predetermined frequency based on a second microwave signal to output the resultant light as a second signal light;

a first signal light emitting unit for converting the first signal light into a signal light beam having a predetermined beam width to emit the signal light as a first signal light beam to space;

a second signal light emitting unit for converting the second signal light into a signal light beam having a predetermined beam width to emit the signal light as a second signal light beam to space;

a spatial optical modulator intensity-modulates the first and second signal light beams directly inputted to the spatial optical modulator to convert the resultant signal light beams into signal light beams having respective desired spatial intensity distributions;

an optical multiplexer for converting the first and second signal light beams different in wavelength outputted from the spatial optical modulator into a single multiplex output signal light beam to travel through one and same coaxial optical path;

an optical synthesizer for synthesizing the other branch light outputted from the first optical demultiplexer and the other branch light outputted from the second optical demultiplexer into a local light;

a local light emitting unit for converting the local light into a light beam having a predetermined beam width to emit the light beam as a local light beam to space;

a beam synthesizer for spatially superimposing the first and second light beams outputted from the optical multiplexer, and the local light beam to form a synthetic beam;

a plurality of optoelectronic converters for spatially sampling the synthetic beam to convert the resultant beam into microwave signals through heterodyne detection to output the microwave signals, respectively; and wherein

the optical control type microwave phase forming device further comprising:

an optical fiber array for transmitting the synthetic beam outputted from the beam synthesizer to the plurality of optoelectronic converters; and

a lens for Fourier-transforming the first and second signal light beams outputted from the spatial optical modulator, the lens being disposed so that its front-side focal surface agrees in position with an output surface of the spatial optical modulator, and its rear-side focal surface agrees in position with an incidence end face of the optical fiber array.

3. (Withdrawn) An optical control type microwave phase forming device, comprising:

a first optical demultiplexer for branching a light radiated from a first light source into two branch lights;

a second optical demultiplexer for branching a light radiated from a second light source into two branch lights;

a first optical frequency converter for deviating a frequency of one of the branch lights outputted from the first optical demultiplexer by a predetermined frequency based on a first microwave signal to output the resultant light as a first signal light;

a second optical frequency converter for deviating a frequency of one of the branch lights outputted from the second optical demultiplexer by a predetermined frequency based on a second microwave signal to output the resultant light as a second signal light;

a first optical synthesizer for synthesizing the first and second signal lights;

a signal light emitting unit for converting the synthetic light outputted from the first optical synthesizer into a signal light beam having a predetermined beam width to emit the signal light as a synthetic signal light beam to space;

an optical branching filter for spatially separating the synthetic signal beam in correspondence to a wavelength band of the synthetic signal light to output first and second signal light beams obtained through the spatial separation;

a spatial optical modulator for phase-modulating the first and second signal light beams inputted to different areas thereof to convert the resultant signal light beams into signal light beams having respective desired spatial phase distributions;

an optical multiplexer for converting the first and second signal light beams different in wavelength outputted from the spatial optical modulator into a multiplex signal light beam to travel a coaxial optical path;

a second optical synthesizer for synthesizing the other branch light outputted from the first optical demultiplexer and the other branch light outputted from the second optical demultiplexer into a local light;

a local light emitting unit for converting the local light into a light beam having a predetermined beam width to emit the light beam as a local light beam to space;

a beam synthesizer for spatially superimposing the first and second light beams outputted from the optical multiplexer and the local light beam to form a synthetic beam; and

a plurality of optoelectronic converters for spatially sampling the synthetic beam to convert the resultant beam into microwave signals through heterodyne detection to output the microwave signals, respectively.

4. (Withdrawn) An optical control type microwave phase forming device according to claim 3, wherein the optical branching filter and the optical multiplexer are disposed symmetrically with respect to the spatial optical modulator.

5. (Withdrawn) An optical control type microwave phase forming device according to claim 3, wherein the spatial optical modulator intensity-modulates the first and second signal light beams to convert the resultant signal light beams into signal light beams having respective desired spatial intensity distributions instead of phase-modulating the first and second signal light beams to convert the resultant signal light beams into signal light beams having respective desired spatial phase distributions,

the optical control type microwave phase forming device further comprising:

an optical fiber array for transmitting the synthetic beam outputted from the beam synthesizer to the plurality of optoelectronic converters; and

a lens for Fourier-transforming the first and second signal light beams outputted from the spatial optical modulator, the lens being disposed so that its front-side focal surface agrees in position with an output surface of the spatial optical modulator, and its rear-side focal surface agrees in position with an incidence end face of the optical fiber array.

6. (Withdrawn) An optical control type microwave phase forming device according to claim 3, further comprising:

a second optical branching filter for spatially separating the local light beam in correspondence to a wavelength band of the local light beam to output first and second local light beams obtained through the spatial separation;

a second spatial modulator for phase-modulating the first and second local light beams inputted to different areas thereof to convert the resultant light beams into light beams having respective desired spatial phase distributions; and

a second optical multiplexer for converting first and second local light beams different in wavelength outputted from the spatial optical modulator into a multiplex light beam to travel through a coaxial optical path,

wherein the beam synthesizer spatially superimposes the first and second signal light beams outputted from the optical multiplexer, and the first and second local light beams outputted from the second optical multiplexer to form a synthetic beam, instead of spatially superimposing the first and second signal light beams outputted from the optical multiplexer and the local light beam.

7. (Previously Presented) An optical control type microwave phase forming device according to claim 1, wherein the optical multiplexer comprises:

a first prism in which the first and second signal light beams are incident and emits the first signal light beam at a first angle and the second signal light beam at a second angle different than the first angle; and

a second prism in which the two emitted light beams are incident, wherein the second mirror is disposed in a place where the two emitted light beams intersect each other and wherein the second mirror converts the two emitted light beams into the single multiplex output signal light beam to travel through the one and same coaxial optical path.

8. (Previously Presented) An optical control type microwave phase forming device according to claim 1, wherein the optical multiplexer comprises:

a first diffraction grating in which the first and second signal light beams are incident and reflects the first and second light beams corresponding to their wavelengths and incident angles; and

a second diffraction grating in which the two reflected light beams are incident, wherein the second diffraction grating is disposed in a place where the two reflected light beams intersect each other and wherein the second diffraction grating reflects the two reflected light beams at different angles corresponding to their wavelengths into the multiplex signal light beam to travel the single coaxial optical path.

9. (Previously Presented) An optical control type microwave phase forming device according to claim 2, wherein the optical multiplexer comprises:

a first prism in which the first and second signal light beams are incident and emits the first signal light beam at a first angle and the second signal light beam at a second angle different than the first angle; and

a second prism in which the two emitted light beams are incident, wherein the second mirror is disposed in a place where the two emitted light beams intersect each other and wherein the second mirror converts the two emitted light beams into the single multiplex output signal light beam to travel through the one and same coaxial optical path.

10. (Previously Presented) An optical control type microwave phase forming device according to claim 2, wherein the optical multiplexer comprises:

a first diffraction grating in which the first and second signal light beams are incident and reflects the first and second light beams corresponding to their wavelengths and incident angles; and

a second diffraction grating in which the two reflected light beams are incident, wherein the second diffraction grating is disposed in a place where the two reflected light beams intersect each other and wherein the second diffraction grating reflects the two reflected light beams at different angles corresponding to their wavelengths into the multiplex signal light beam to travel the single coaxial optical path.